AIPSLETTER

Volume XI, Number 2: April 15, 1991

A newsletter for users of the NRAO
Astronomical Image Processing System

Edited by
Gareth Hunt
National Radio Astronomy Observatory
P. O. Box 0, Socorro, NM 87801-0387
505–835–7000, x7213; TWX 910–988–1710; Fax 505–835–7027
and
Glen Langston
National Radio Astronomy Observatory
Edgemont Road, Charlottesville, VA 22903–2475
804–296–0211, x209; TWX 910–997–0174; Fax 804–296–0328
aipsmail@nrao.edu or aipsmail@nrao.bitnet or
6654::aipsmail or ...!uunet!nrao.edu!aipsmail

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Recent Developments

The structure and focus of the *AIPS* programing group was redefined in January 1991. In summary, the *AIPS* group, under the leadership of Geoff Croes, has decided to re-write *AIPS* in order to incorporate software capabilities needed for the coming decade. The new *AIPS* software will be written in the language C++, and here after, the new *AIPS* will be called *AIPS*++.

A major consequence of this plan is that *AIPS* has been frozen. Current software development in *AIPS* is limited to improvements needed in the short term for VLBA calibration and certain experimental imaging tasks. Of course, bugs will be fixed as soon as possible. However, if bugs can be "worked around" using existing *AIPS* software, these bug fixes will have very low priority. Because most software developement effort must go towards *AIPS*++ no extensive software modifications to old *AIPS* can be supported.

As a consequence of the *AIPS*++ developement, the manpower we have available to support *AIPS* has been dramatically reduced, therefore we have decided to cease releasing *AIPS* every quarter. The 15APR91 version of *AIPS* is the last planed release until 15APR92, however, we may release another version in 15OCT91. The decision as to when to release the next *AIPS* version depends on the amount of VLBA software development that occurs over the next few months.

Personnel

There are three imminent changes to personnel. Both Phil Diamond and Bill Junor are leaving the *AIPS* group to devote themselves to the operation of the VLBA. Bill will leave in September 1991, and Phil in January 1992. Bill Junor's position is being filled by David Adler, who will join the *AIPS* group in August.

Gareth Hunt continues as head of the *AIPS* user support in Socorro. Glen Langston heads *AIPS* user support in Charlottesville as well as continuing to develope imaging and self-calibration software for the

VLBA.

AIPS++

The goals and design requirements for *AIPS*++ will be described in a separate document. Because many man-years of work will be needed to create *AIPS*++ most of the *AIPS* scientists will be working only on *AIPS*++. The *AIPS*++ development is headed by Geoff Croes. The *AIPS*++ software development is planned as an international collaboration, with programmer support committed by Jodrell Bank, Westerbork, the Australia Telescope, and the Tata Institute in India. Addtional U.S. support is committed by the Berkeley-Illinois-Maryland Millimeter Array. The NRAO scientists currently working on *AIPS*++ are Bill Cotton, Chris Flatters, Brian Glendenning.

AIPS++ is still in the early stage of development, and discussion on various topics is being carried out via electronic mail. Several email "exploders" for discussion of issues related to *AIPS*++ have been created. The traffic to date has been logged, and is available via anonymous `ftp` from baboon.cv.nrao.edu (192.33.115.103) under the pub/mailing-lists/aips++ directory. If after viewing the contributions to date you are interested in joining the general AIPS++ mailing list, send email to aips2-request@nrao.edu.

Here is a short example of retrieving the logged traffic via `ftp` from a unix machine. If you are unable to use `ftp`, email to aips2-request@nrao.edu and ask for the traffic to date to be mailed to you.

```
% ftp 192.33.115.103                          (if baboon.cv.nrao.edu doesn't work)
Connected to 192.33.115.103.
220 baboon FTP server (SunOS 4.1) ready.
Name (192.33.115.103:bglenden):  anonymous
331 Guest login ok, send ident as password.
Password:bglenden@nrao.edu                          (use your email address)
230 Guest login ok, access restrictions apply.
ftp> cd pub/mailing-lists/aips++
250 CWD command successful.
ftp> get aips2.log
200 PORT command successful.
150 ASCII data connection for aips2.log (192.33.115.19,1301) (588302 bytes).
226 ASCII Transfer complete.
local:  aips2.log remote:  aips2.log
602684 bytes received in 4.5 seconds (1.3e+02 Kbytes/s)
ftp> quit
221 Goodbye.
```

Reports from the 1991 *AIPS* Site Survey

Two reports prepared from the 1991 *AIPS* Site Survey data are available as *AIPS* Memos.

The "1991 *AIPS* Site Directory" (*AIPS* Memo 69 by Alan Bridle and Joanne Nance) lists hardware and *AIPS* usage data for the 139 *AIPS* sites whose *AIPS* activity was measurable from the survey data. The directory lists data for 204 computer systems at these 139 sites. It also contains the postal and E-mail addresses, and telephone numbers, for the Contact People at each site. Its main purpose is to help *AIPS* Site Managers who want to locate other *AIPS* sites that have hardware, use patterns and scientific interests similar to their own. It was distributed in April to the designated Contact People at all sites that are listed in the Directory. If you would like a personal copy, please use the *AIPS* order form at the back of this AIPSLETTER.

A report entitled "The 1990 *AIPS* Site Survey" (*AIPS* Memo 70 by Alan Bridle and Joanne Nance) analyzes the demography and growth patterns of the computing hardware in the worldwide *AIPS* community. Its main purpose is to help people who plan *AIPS* hardware development at the NRAO and elsewhere to interpret recent trends in the *AIPS* community. It also contains *AIPS* performance estimates for a wide variety of computers on which *AIPS* is now running. This report may be particularly interesting to anyone seeking to make, or to justify, a new CPU or major peripheral procurement for *AIPS* use. For your convenience, we reprint the summary of its main conclusions below:

1. There has been roughly three-fold growth in the average machine (CPU) power per user throughout the *AIPS* community since 1988. "Affordable" machine power is growing faster than the number of *AIPS* users, so we are now in a desirable growth phase in which the average resource per *AIPS* user can become a better match to the data-processing needs of array telescopes.

2. The *AIPS* computing power is increasingly concentrated into machines that use large fractions of their CPU time to run *AIPS* — the "share" of the computing burden borne by such "highly active" *AIPS* machines has increased, and is now almost 80% of the total.

3. UNIX-based systems now provide 93% of the concentrated machine power used for *AIPS* data processing. The need for long-term support of *AIPS* under VMS is now highly questionable. The *AIPS* sites that still use VMS machines should therefore be encouraged to convert to UNIX as soon as possible.

4. Most of the growth in active *AIPS* CPU power since 1988 has been in scalar RISC workstations without classical vector processors, rather than in vector- register machines (mini-supercomputers). The number of scalar machines used for *AIPS* increased from 115 to 305 since 1988, while the number of vector-register machines increased only from 18 to 22. Only about a third of *AIPS* data processing is now done with the aid of classical vector hardware. The use of stand-alone AP's continues to decline.

5. The fraction of *AIPS* use that is devoted to VLA data processing has increased to 74% at the U.S. sites outside the NRAO, but continues to decrease at the NRAO and in other countries. Most of the non-VLA use of *AIPS* is for other radio applications (VLBI, AT, MERLIN, WSRT etc.). Use of *AIPS* for non-radio applications continues to be about 12% of the total.

6. About 34% of all VLA data processing by *AIPS* in the U.S. is supported by NSF funds. The NSF and NASA together support about 54% of the *AIPS* CPU power in the U.S. "Local initiatives" have almost matched the total *AIPS* CPU power supported by the two main federal sources of funds for astronomy. At *AIPS* sites with any NSF funding for *AIPS* computers, the NSF's contribution to the *AIPS* CPU power averages 70%.

7. Computers at the NRAO now provide about 16% of the total *AIPS* CPU power devoted to VLA data processing, down from 19% in 1988. The NRAO's share of all active *AIPS* CPU power has stabilized near 14%.

8. The total *AIPS* machine power now in use for VLA data reduction around the world falls short of that needed to meet the full scientific potential of the VLA by a factor of about eight. Machine powers in the range from high-end "compute server" workstations to second- or third-generation mini-supercomputers are particularly needed to augment the available hierarchy."

Sites that are still running *AIPS* under VMS should take particular note of conclusion 3! This report has been distributed to the standard *AIPS* memo recipients. If you want a personal copy, please use the *AIPS* order form at the back of this AIPSLETTER.

Please send any questions or comments about the *AIPS* Site Survey or these reports to Alan Bridle (abridle@polaris.cv.nrao.edu, 804-296-0375).

Gripes

A new system for maintaining the *AIPS* "Gripes" has recently been implemented and is now available for public use. Bill Cotton has created an "AIPS Gripes Database" which is built within the EMACS editor. Each gripe (approximately 4800 to date) is now entered into the database as an individual file. These files can be accessed with various query modes (query by gripe number, username, gripe date, etc.), thus making it fairly simple and convenient to use.

The *AIPS* Gripe Database currently resides on virtual machine called "gripe" at NRAO-Charlottesville. A public account has been set up on this machine; No username or password is required. To use the database from outside NRAO, you may telnet to "gripe.cv.nrao.edu" (or to address 192.33.115.103). From within NRAO, simply remote login to `baboon.cv.nrao.edu` with the account name "gripe".

To obtain a copy of the "User's Guide to the *AIPS* Gripe Database" we have set up an "anonymous `ftp`" account on a Unix machine in Charlottesville. The directory /local/ftp/pub/gripes on polaris.cv.nrao.edu (or 192.33.115.101) contains an ascii file called GRIPEDOC which explains the basics of using the database.

If you have any problems or comments, please contact either Bill Cotton (`bcotton@nrao.edu`) or Dean Schlemmer (`dschlemm@nrao.edu`).

Documentation Available

The *AIPS* `COOKBOOK` has been updated recently, and new version chapters 4, 6 and 11 are available. Several new *AIPS* memos are also available.

Memo 66: An Overview of *AIPS* TV Servers.

Memo 67: *AIPS* DDT bench mark results for Sun's SPARCstation 2GX.

Memo 68: Summary of *AIPS* *uv*-data Calibration from VLA Arcive tape to a *uv*-FITS tape.

Memo 69: The 1991 *AIPS* Site Directory.

Memo 70: The 1991 *AIPS* Site Survey.

Memo 71: A Comparison of DDT results for IBM RS/6000 and Convex C-1.

Memo 72: MAPIT: Automatic *AIPS* Imaging and Self-Calibration.

Memo 73: *AIPS* DDT History.

Changes in `15APR91` of interest to programmers

The changes to `15APR91` are summarized below and a few topics are discussed in more detail. There were 301 "significant changes" to `15APR91`.

TVs Many improvements were applied to the *AIPS* workstation TV emulators.

Calibration A suite of procedures were created to validate the VLA calibation software.

`TVFLG` A few bugs werer found and fixed for graphical editing of *uv*-data.

FQ ids Several bugs were fixed in Multi FQ id *uv*-data processing.

Decstation The Decstation low level routines were added to the *AIPS* code heirarchy.

Westerbork Code was added to the *AIPS* Contribution area ($APLCONTR) to read and process Westerbork data.

Scratch The *AIPS* scratch file handling has been changed to allow several CPUs to create files on the same disk. Scratch files from one CPU are no longer inadvertently distroyed by other CPUs.

Pseudo-AP The Pseudo-Array processor include files have been modified to allow system managers to easily increase the array sizes. Increasing the Pseudo-AP size increases mapping efficiency.

Tapes *AIPS* now allows remote access of tapes. In particular, several workstations may now share a single exabyte tape drive.

`BPASS` Fix of Band Pass corrections for dual polarization data bases.

`MX` `MX` mplimentation of the Zero-spacing flux has been modified to allow a gaussian model for the source short spacing flux distribution. Data selection was modified to handle multi-frequency *uv*-data. Also cleaning now stops at first negative CC if requested.

`UVPRM` `UVPRM` has three functions, to find a reference antenna, the maximum *uv*-spacing in the *uv*-data and to find the UV-spacing at which the average flux of the source is greater than the input FLUX. Usefull for self-calibration.

`CCFND` `CCFND` finds the last clean component before a negative clean component then finds the clean component FACTOR brighter than the negative component. Useful for setting self-calibration parameters.

`DECOR` New task to compute the decorrelation amoung a set of selected correlations. The output values have a real part that is the ratio of the scalar amplitude average of the selected correlations to the vector average. This progam is especially useful for looking for coherence problems in multi IF and/or multi channel data. This task allows application of calibration and/or editing and will write a new multi source file.

`SHOUV` `SHOUV` is a new task that does column listings of closure phases for selected triplets or listings with different IF/channels in different columns. These displays are very useful for detecting and analysing problems in multi IF/channel data sets.

`GLENS` Gravitational LENS modeling program. Makes models of a Blandford elliptical galaxy or a point mass (black hole).

`ANCAL` Added capability to give baseline dependent calibration factors by writing a BL table if "BASELINE" cards are present in the calibration file. This implementation allows only one set of baseline factors per uv data file.

`DBCON` Fixed a problem with VLBI data that the AN tables in the two files which may be inconsistent. The ANntenna tables are merged if they have compatible AN table headers and the data are to be written as one subarray.

`MOMFT` First, second and third moments of flux density distributionof images. Gives a more reliable measure of compact source structure.

`CVEL` `CVEL` now works properly for dual polzn data. Also for MkIII data corrections are applied for changing reference stations.

`ACFIT` `ACFIT` now correctly handles dual polarization data.

`SNPLT` Additional plotting options were added for VLBI data.

`SNSMO` New task to filter SN tables. Much of the smoothing functionality of `CLCAL` is reproduced but this task included two useful model for smoothing `FRING` VLBI solutions. Coupled smoothings of delay (single and multiband), rate, amplitude and phase. The methods attempt to maintain coherence amoung the IFs of a given Stokes' parameter (but not between Stokes'). This task should be very useful for MkIII VLBI and VLBA data.

`HORUS` Error in applying UNIFORM weighting corrected.

`FILLM` A few more "rare" bugs fixed.

`MK3IN` Extensive improvements and enhancements were made by Athol Kemball and Bill Cotton. Of particular note are improvements in handling Spectral Line Data. The new `MK3IN` produces an FQ table and allows multiple observing bands. Some changes in the Fourier transform conventions were neccessary in handling multiple correlator module lag functions. In particular the lag order convention needed to be reversed to concatenate the output of the modules.

AC functions are treated separately and are corrected for bias and clipping effects before being transformed to AC spectra. Auto-correlation functions are typically generated by cross-correlating half the XC lag range. Individual correlator modules can however be placed in auto-correlation mode and this may be used in the future. Some changes in the code were neccessary to deal with the two methods of generating AC functions.

Correlation functions which do not have the same number of lags as the output file are skipped and a warning is printed. This is neccessary to avoid 8-lag fringe finding scans which are often included in the output tape.

Some checks were introduced to ensure that the A-tape file structure is as expected by `MK3IN`. The A-tape file headers are decoded and the MK3 file parameters are extracted. A warning is printed if the tape is a member of a multi-volume SAVEM set, as this may cause loss of data. The type 50 records within each extent are required to be in the expected order and only complete scan-baseline headers are used.

These checks should diminish the effect of tape errors which may cause loss of synchronization and will also alert the user to any future changes in the MK3 data format.

The data rejection criteria used by FRNGE at the Haystack correlator were implemented in the new `MK3IN` version. A breakdown of the error statistics is available for each scan which can optionally be indexed on correlator module serial number. This feature was requested by the Bonn correlator group for spectral line data.

The MK3 tape format is baseline-based and consequently there is a high degree of redundancy in source- and antenna-based parameters which is the format that AIPS requires. The new version of `MK3IN` assumes that source and antenna parameters in files for different baselines may not be consistent and carries out several checks in this regard. The data are not rejected or changed in any way but a warning message is printed. The correlator model input parameters (or closely associated quantities) are also monitored throughout the run. A summary of the correlator model is printed at the end of the run. These consistency checks should help to isolate problems in the data set caused by changes in the correlation strategy or when merging data correlated at different times or different correlators. These checks may also alert the user to any unnanounced changes in the MK3 output tape format.

A correlator index is generated from the 20XX module cross-reference table before processing each new type 51 data extent. This allows video converters to be multiply assigned in a given scan and should allow XC/AC mixing. The delay offsets can be in arbitrary order in the cross-ref table.

MAPIT

A set of *AIPS* procedures, called MAPIT, has been developed to automatically image and self-calibrate *uv*-data. This set of procedures works particularly well for VLA snapshots and observations of radio sources with compact structure. The MAPIT proceedures have been successfully used to produce images of VLBI observations.

Remote tape dirves

To get the remote tape stuff going do the following on the machine that is going to run *AIPS* (not the machine with the tape drive). I presume that it is a Sun.

Add the string -DREMOTE_TAPES to the COMP line in CCOPTS.SH, *e.g.*,

```
COMP="-v -c $OPTO -pipe -PIC -DREMOTE_TAPES"
```

or use the string as one of the arguments to COMRPL, *e.g.*,

```
COMRPL $APLBERK/ZRMTAP.C DEBUG -DREMOTE_TAPES NOPURGE
```

% COMRPL $APLBERK/ZRMTAP.C	Compile Berkeley Unix subroutines
% COMRPL $APLBERK/ZTAP*.C	"
% COMRPL $APLBERK/ZTP*2.C	"
% COMLNK $AIPPGM/AIPS.FOR	Re-Link main *AIPS* program
% COMLNK $APLPGM/AVTP.FOR	Re-Link tape utility program
% COMLNK $APGNOT/FILL*.FOR	Re-Link tasks to read VLA archive tapes
% COMLNK $APGNOT/FIT*.FOR	Re-Link tasks to write FITS format tapes
% COMLNK $APGNOT/IMLOD.FOR	Re-Link task to read FITS IMAGES
% COMLNK $APGNOT/MK3IN.FOR	Re-Link task to read Mark 3 VLBI data
% COMLNK $APLPGM/PRTTP.FOR	Re-Link task to print contents of a tape
% COMLNK $APGNOT/UVLOD.FOR	Re-Link task to read *uv*-data

Assign the MT0x environment variable which you want to use (for tape number x+1). The may have to be done in ASSNLOCAL.CSH, but can probably be done with a setenv or export before running the *AIPS* script. The latter is possible with the default *AIPS* script. For example:

```
setenv MT00 nrao1:/dev/rmt21   "for AIPS tape #1"
```

If the remote tape is on a Convex, you will need to tpmount the tape from the account from which you are running *AIPS* on the Sun via rsh or equivalent. If the remote tape is on a Sun or other compatible workstation, you can omit this step.

In *AIPS*, type

```
INTAPE n; TASK 'task'; GO
```

No MOUNT command is needed. Things should work.